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**Post-traumatic growth in head and neck cancer survivors: is it possible and what are the correlates?**

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## ABSTRACT

**Objectives:** Posttraumatic growth (PTG) is a possible positive consequence of a traumatic event, such as cancer. Head and neck cancer (HNC) may be particularly traumatic, given its adverse effects on functional, psychological and social wellbeing. We investigated: extent of PTG; factors associated with PTG; and associations between PTG and health-related quality-of-life (HRQoL) in HNC survivors.

**Methods:** HNC survivors (ICD10 C00-C14, C32), identified from the population-based National Cancer Registry Ireland, completed a postal survey. PTG was assessed using the Posttraumatic Growth Inventory (PTG-I) and HRQoL with FACT-G and FACT-HN. Associations between socio-economic characteristics, social support, and clinical variables and PTG were examined using multivariable linear regression. Total HRQoL scores were compared in those with none-low PTG vs moderate-high PTG.

**Results:** 583 survivors participated (response rate=59%). The mean PTG score was 55.74 (95%CI 53.15-58.33); 60% had moderate-high PTG. Survivors scored highest in the PTG-I domain appreciation of life. In multivariable analysis, being female, being younger, having more social support and having cancer-related financial stress were significantly associated with more PTG. HRQoL was significantly higher in those with moderate-high than no-little PTG ( $p<0.01$ )

**Conclusion:** A notable proportion of HNC survivors report PTG but growth is, on average, lower than reported for other cancers. Nonetheless, higher PTG appears related to better HRQoL. Further research would be valuable to understand the pathways by which HNC may lead to PTG and inform development of strategies to support and encourage PTG in this survivor population.

## BACKGROUND

A cancer diagnosis is a stressful event that may have significant long-term psychological, social and functional adverse effects. This may be argued to be especially true of head and neck cancer (HNC).

Treatment is frequently multi-modal and often aggressive and, like survivors of many cancers, HNC survivors may experience various cancer-related symptoms, including fatigue and pain, which can result in quality-of-life decrements [1]. However, HNC and its treatment can also lead to visible disfigurement and have detrimental effects on many functions and activities of daily living; survivors often have problems with speech or voice, breathing, eating or swallowing and experience mucositis, xerostomia and trismus, all of which can impact adversely on psychological and social wellbeing [2-5].

Recently interest has grown in the potential for cancer survivors to experience positive consequences of their illness. One such positive consequence is posttraumatic growth (PTG). PTG refers to positive changes that result from a struggle after a traumatic event [6]. It may occur in the months and years following the event and manifest in various ways including increased appreciation for life, more meaningful interpersonal relationships, and richer existential and spiritual life [6]. However, traumatic events are insufficient in themselves to cause PTG; instead an individual must reflect on their experiences and seek to find meaning in them [7] i.e. growth arises from adaptation to the trauma and rebuilding one's sense of the world [6].

Accumulating research indicates PTG may occur among cancer survivors [7,8]. In HNC, one qualitative study suggested most survivors may experience positive changes, including changed attitudes towards life, re-ranking of priorities, greater engagement in activities, personal growth (including being more appreciative and feeling emotionally stronger), and more openness relating to others [9]. Another qualitative study proposed that distress may act as a catalyst for growth [10]. However, the extent of PTG among HNC survivors, and which survivors are more likely to experience PTG, remains unclear. The two quantitative studies in HNC suggest PTG is higher in individuals who are married, do not have alcohol use disorders, have better social functioning and have higher levels

of hope and optimism [11,12], but both studies were small (N=50 and 74, respectively). Moreover, one reported only unadjusted results [11] and, in the other, all participants had anxiety or depression [12].

Studies in other cancers have suggested PTG may lead to additional positive effects. Higher PTG has been associated with better quality-of-life [13,14], better physical wellbeing and lower distress [15].

In addition, it may mediate the impact of stressors, such as comorbidity, on quality-of-life [16].

We investigated, in HNC survivors: (i) extent of PTG; (ii) associations between socio-economic characteristics, social support, and clinical variables and PTG; and (iii) whether PTG and health-related quality-of-life (HRQoL) are related. Given the limited previous research on PTG in HNC, our analysis was intended to be hypothesis-generating rather than hypothesis-testing.

## **METHODS**

### **Participants**

In April 2012, survivors of primary HNC (ICD10 C00-C14, C32) were identified from the population-based National Cancer Registry Ireland (NCRI). The NCRI records incident cancers among residents of the Republic of Ireland; completeness of registration is high ([www.ncri.ie](http://www.ncri.ie)). Eligible survivors were  $\geq 18$  years at diagnosis,  $\geq$ eight months post-diagnosis, and treated in one or more of 14 hospitals, encompassing all major HNC treating centres in the country. The treating consultant of each survivor was invited to confirm the individual: was alive and aware they had cancer; had completed treatment; was not in the terminal phase; and that there was no medical or other reason why it would be inappropriate to contact them. Survivors considered ineligible by the consultant, or whose treating clinician did not respond, were excluded.

### **Compliance with ethical standards**

The study accorded with the ethical standards of the 1964 Declaration of Helsinki and later amendments. The research ethics committee for each participating hospital approved the study, and participants provided signed informed consent.

## Measures

A postal questionnaire was distributed to survivors considered eligible by consultants (n=991). Up to two reminders were sent at fortnightly intervals. The questionnaire included the Posttraumatic Growth Inventory (PTG-I), a reliable and validated 21-question instrument that measures overall PTG and growth in five dimensions: relating to others (7 items), new possibilities (5), personal strength (4), spiritual change (2) and appreciation of life (3) [17]. For each item respondents were given a statement that described a change they could have experienced (e.g. 'I have developed new interests') and asked to indicate the degree to which they experienced this change as a result of their cancer diagnosis and treatment. Responses options were on a 5-point likert scale, ranging from '0' ('I did not experience this change') to '5' ('I experienced this change to a very great degree'). Item responses were summed to generate an overall PTG score in the range 0-105; a higher score implies greater PTG. We computed scores for each domain; the range of possible scores depends on the number of items in the domain. For respondents who answered at least half, but not all, PTG questions we imputed missing values using the mean of their responses to the completed questions. This was done for the overall score and domain scores.

The questionnaire collected information on socio-demographic variables (sex, age, marital status, highest level of education completed, and number of children). The deprivation category of the survivor's area of residence (based on 2002 census data [18]) was obtained from the NCRI. Following previous work [19], financial circumstances were assessed in terms of: pre-diagnosis financial stress (household ability to make ends meet at diagnosis; classified for analysis as difficult vs easy), post-diagnosis cancer-related financial stress (impact of cancer on household ability to make ends meet; classified as more difficult vs no change/less difficult) and post-diagnosis cancer-related financial strain (feelings about household's financial situation since diagnosis with cancer; classified as more concerned vs no change/less concerned). Amount of social support was assessed using the Oslo Social Support Scale [20], and classified as poor, moderate and strong. Following Gray et al [21], survivors rated their agreement with two statements about satisfaction with social support during

and after treatment. Regarding clinical variables, the questionnaire asked about recurrence and the NCRI database provided information on cancer site, time since diagnosis, and cancer-directed treatment(s) received within 8 months of diagnosis. HRQoL was measured using the Functional Assessment of Cancer Therapy General questionnaire (FACT-G) and the HNC component (FACT-H&N), both of which are validated and widely used [22,23]. For each of 39 HRQoL statements, participants rated the extent to which they applied in the past 7 days. The total HRQoL score was computed as recommended; for respondents who had answered at least half, but not all, 39 questions missing responses were imputed using the individual's mean score from completed questions. A higher total score indicates higher HRQoL.

### **Statistical analysis**

Analysis was conducted in SPSS v23. Respondents' and non-respondents' socio-demographic and clinical characteristics were compared using chi-square tests. Primary analysis used the dataset including the imputed PTG values. We computed mean overall PTG score, mean domain scores, and mean per-question scores. Following Jansen et al [11], a mean overall PTG per-question score  $<2.5$  was classified as no-little PTG and  $\geq 2.5$  was classified as moderate-high PTG. In sensitivity analysis we compared scores in the primary dataset with those obtained restricting analysis to respondents who answered all PTG questions. Total PTG scores were compared between subgroups defined by the socio-economic, social support and clinical variables, using ANOVA tests. A multivariable linear regression model was developed. Candidate variables are shown in Table 1. Variables were fitted simultaneously if the p-value for the F-test in the relevant univariable regression was  $<0.2$  (because of the hypothesis-generating nature of the analysis). Each variable was then dropped individually from the model; those where the F-change test p-value was  $<0.2$  were included in the final model. Care was taken to avoid multicollinearity; variance inflation factors for the variables in the final model were  $<2.4$  and tolerance  $>0.4$ . Assumptions underlying linear regression were not violated. To explore the relationship between total PTG and HRQoL we ran a correlation, using Spearman rank because HRQoL scores were skewed. For further illumination, we compared the HRQoL score

distribution in those with none-little vs moderate-high PTG using the Mann-Whitney U test. Because the cut-off for no-little vs moderate-high PTG is unvalidated, as a sensitivity analysis we repeated this analysis classifying total PTG scores into tertiles (low <49/intermediate 49-70/high >70) so that approximately one-third of participants were in each category.

## **RESULTS**

### **Characteristics**

583 survivors participated (response rate=59%). Respondents and non-respondents did not differ significantly by sex, stage or cancer site but respondents were more often <60 ( $p<0.01$ ) and less often 10+ years post-diagnosis ( $p=0.02$ ).

Of respondents, 67% were male; ages ranged from 28 to 92; 71% were married/cohabiting; and 36% had completed primary level education only (Table 1). The most common site was oral cavity (39%), followed by larynx (31%) and oropharynx (16%); 15% had cancer in another site in the head and neck. One third had had surgery alone, 39% had surgery with (neo-)adjuvant radiation +/- chemotherapy, 17% had radiotherapy alone and 11% chemo-radiation.

### **Overall PTG and domain scores**

The mean overall PTG score was 55.7 (95%CI 51.2-58.3); 60% of survivors had a score consistent with moderate-high PTG (Table 2). The highest mean scores per question were for appreciation of life (3.29) and relating to others (2.98).

In sensitivity analysis, among respondents who answered all PTG questions ( $n=387$ ), the mean scores were virtually identical to those from the primary analysis dataset (Supplementary table 1).

### **Associations between explanatory variables and overall PTG score**

Overall PTG score varied significantly by sex (more growth in females), age at survey (more growth in younger survivors), amount of social support (more growth in those with more social support), pre-diagnosis financial stress (more growth in those with more difficult financial situation) and both



cancer-related financial stress and financial strain (more growth in those with more difficulties/concerns)(Table 1).

In the multivariable model, four variables remained associated with overall PTG: sex, age at survey, social support and cancer-related financial stress (Table 3). The association with age was borderline statistically significant ( $p=0.07$ );  $p<0.05$  for the other three variables. Together, these variables explained 13.4% of variance. On average, the mean PTG score was 7.21 (95%CI 2.64-11.78) points higher in females than males. Compared to respondents  $<60$ , the score was slightly (and non-significantly) lower those aged 60-69 and 7.90 (95%CI 2.27-13.53) points lower in those aged 70+. Compared to those with poor social support, the score was 16.32 (95%CI 9.81-22.83) points higher in those with moderate support and 21.40 (95%CI 14.95-27.85) points higher in those with strong support. Those who did not experience cancer-related financial stress had a 8.36 (95%CI 3.97-12.75) point **lower score** than those who experienced this.

### **Overall PTG and HRQoL**

There was a statistically significant, but weak, correlation between overall PTG and HRQoL (Spearman  $\rho=0.12$ ,  $p<0.01$ ). HRQoL was significantly lower in those with no-little PTG (median HRQoL=116.3) than those with moderate-high PTG (median HRQoL=124.1;  $p=0.01$ ). In the sensitivity analysis, classifying PTG into tertiles, this association persisted (low PTG, median HRQoL=116.7; intermediate PTG, 120.3; high PTG, 126.0;  $p=0.01$ ).

### **DISCUSSION**

We have documented the extent of PTG in HNC survivors, identified subgroups who experience more PTG and demonstrated, for the first time in HNC, a positive association between PTG and HRQoL. The mean PTG-I score was 55.74 and 60% scored in the range for moderate-high PTG. While this demonstrates HNC survivors may experience PTG, most studies in survivors of other cancers which used the same instrument reported higher average scores (see, for example, two breast

cancer studies in which the mean PTG scores were 64.1 and 70.2, and a study of those who had had bone marrow transplantation following cancer, in which the mean score was 64.7 [24-26]). The mean score here was similar to that reported in one previous HNC study (51.8)[11], but was higher than in the other HNC study (30.8); however, in that study, all participants had anxiety or depression [12]. It is possible that the impacts of HNC and its treatment (such as the functional limitations and problems with activities of daily living) make reassessment of one's life and adaptation to the traumatic event difficult thereby inhibiting PTG. In addition, HNC incidence is associated with lower socio-economic status [27] and other cancer studies have shown associations between lower socio-economic status (or markers of this) and less PTG [11,14,26]. Cultural differences in PTG have been hypothesized [28]. Such differences might possibly explain the low average PTG score in our study, but we are not aware of any empirical data to support this.

Females had more PTG than males, although this was only borderline statistically significant in the multivariable model. Most previous cancer studies have found no association between PTG and sex, but the few that have documented associations reported greater growth in females [6, and references therein], consistent with other traumatic events [29]. Women are more likely to use emotion-focussed coping styles, such as positive reappraisal, rumination and positive self-talk [30]. Emotion-focussed coping involves thinking about the event and trying to make sense of it [29], essentially the process proposed to operate in PTG. There is also some evidence that women tend to appraise stressors as more severe than men [30]; potentially, appraising stressors as more severe could affect how the individual struggles to make sense of the new reality following the traumatic event thereby influencing PTG. However, convincing evidence for gender-differences in coping strategies or stressor appraisal in HNC (and links between the latter and PTG) is lacking. Further research would be valuable to elucidate these issues.

Our finding of more growth in younger survivors is consistent with other cancers [6]. In breast cancer it has been suggested that perceiving cancer as more threatening facilitates PTG [31]. While information on perceived threat of HNC by age is lacking, younger survivors more often report fear of recurrence as their greatest concern [32]. Bellizzi [33] suggested that younger survivors of traumatic events experience more growth because they realise they have more time left to accomplish desired goals, whereas older survivors reach a peaceful acceptance about their life situation. It might be speculated, therefore, that older HNC survivors are more fatalistic or resigned to their situation, making them less likely to engage in the emotional processing that can lead to PTG. A further possibility is that age may be a marker for another correlate of PTG, such as employment status or (absence of) comorbidities [26].

Survivors who reported more social support also reported greater PTG and the effect was large.

While this is consistent with Tedeschi and Calhoun's [6] theoretical model and studies in other cancers [34,35], it is important given the high levels of loneliness among HNC survivors [36]. It is theorized that having strong social support enables the individual to discuss their feelings, ask for advice and make sense of what is happening, ultimately helping them redefine their life's assumptions positively (i.e. generating PTG) [6].

The association between cancer-related financial stress and greater PTG is intriguing and, as far as we are aware, novel among cancer survivors. In informal caregivers of the survivors in the current study we found a similar association [37]. As suggested in that paper, experiencing financial stress due to cancer may increase the resulting trauma, enabling more PTG, but this is simply speculation. Further exploration of the role of financial and economic factors in PTG is warranted.

It would be of considerable value to identify potentially modifiable predictors of HRQoL. Our observation that higher PTG is significantly associated, albeit in an unadjusted exploratory analysis in a cross-sectional study, with higher HRQoL is consistent with emerging findings for other cancers.

For example, among 483 colorectal cancer survivors, mean QoL scores were significantly higher in

those with moderate-high than no-little PTG [13]; among 122 stomach cancer survivors, higher PTG was significantly associated with better social/family and functional wellbeing [14]; and in 60 breast cancer survivors greater PTG was associated with decreased psychological distress [15]. Thus, it appears that PTG may be related to various aspects of HRQoL. Moreover, while experiencing little or no PTG may not be detrimental *per se*, these associations suggest that there may be wider benefits to PTG and, moreover, that interventions or strategies to support or enhance PTG might have positive impacts on survivors' HRQoL.

### **Clinical implications**

Our findings may make health professionals more alert to the fact that PTG is possible in HNC survivors and could be encouraged and supported. This needs to be done with care as making survivors feel like PTG is expected can result in negativity [24]. Interventions to facilitate PTG have been developed, but few have been tested in cancer survivors [38], and it is unclear whether or how interventions need to be modified for different groups. Indirect routes to encourage PTG may bring benefits, such as finding ways to increase social support (e.g. through cancer buddy schemes [39]), or adaption of existing interventions to reduce social isolation [40]. Since men and older survivors are vulnerable to low PTG, it is important to ensure that any such interventions appeal to these groups.

From a research perspective, while theories have been postulated as to why some individuals experience more PTG than others, empirical data is limited. Qualitative research would be of value to explore the pathways which lead to PTG in both male and female HNC survivors, as would longitudinal quantitative studies tracking the natural history of PTG over time in different survivor groups.

## **Study limitations**

This is the largest quantitative study of PTG in HNC. While survivors were identified from a population-based sampling frame, the response rate was 59%. Older survivors were less likely to participate and respondents who did not complete sufficient PTG questions to be included in analysis were more often older and female. Both gender and age were associated with growth but in opposite directions making it impossible to be certain whether we may have under- or over-estimated PTG. In addition, we cannot exclude the possibility that survivors with particularly high, or particularly low, PTG participated.

## **Conclusions**

Moderate-high PTG is evident in more than half of HNC survivors and some subgroups (women, younger survivors, those with social support and those who experience cancer-related financial stress) have greater growth. Moreover, greater growth is associated with higher HRQoL, suggesting strategies to encourage and support PTG in HNC survivors may yield benefits.

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## **CONFLICT OF INTEREST**

The authors have no conflicts of interest to declare.

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**Table 1: Respondents' characteristics, mean overall PTG scores with standard deviations and p values**

Variable	n	%	Mean PTG	SD	F	p-value
Sex						
Male	392	67	51.39	24.73	10.53	<0.01
Female	191	33	60.14	24.20		
Marital status						
Married/cohabiting	413	71	54.14	24.75	0.15	0.70
Other	165	29	54.16	25.30		
Children						
None	135	24	52.00	25.48	0.72	0.50
1-3	248	45	55.73	24.02		
4+	171	31	53.28	25.77		
Education						
Primary	190	36	54.41	26.43	0.56	0.64
Secondary	254	47	53.82	23.50		
University	59	11	52.36	27.03		
Post-graduate	32	6	60.35	20.20		
Age at survey						
<60	204	35	59.48	22.42	5.47	<0.01
60-69	217	37	58.22	26.44		
70+	160	28	50.28	27.46		
Deprivation category						
1 least deprived	100	23	51.08	24.05	1.02	0.41
2	73	18	54.17	24.27		
3	81	19	57.02	24.74		
4	98	18	53.71	26.41		
5 most deprived	179	33	56.24	24.64		
Unknown	52	9	49.43	25.51		
Cancer site <sup>1</sup>						
Oropharynx	93	16	60.22	22.77	1.73	0.16
Oral cavity	225	39	53.06	24.77		
Larynx	178	31	53.41	25.96		
Other	87	15	50.75	24.76		
Stage at diagnosis						
I	169	41	52.81	25.33	0.45	0.77
II	108	18	55.23	25.40		
III	77	11	50.95	24.00		
IV	137	20	58.72	23.43		
Unstaged	92	15	51.07	26.00		
Years since diagnosis						
<5	289	50	54.82	24.30	1.43	0.24
5-9	199	34	58.07	25.18		
10+	92	16	59.51	29.75		

**Table 1: Cont'd**

Recurrence						
Yes	34	6	56.99	22.82	0.31	0.58
No	516	94	53.94	25.02		
Treatment received <sup>2</sup>						
Radiotherapy alone	86	17	54.54	25.33	1.45	0.23
Chemo-radiation	59	11	57.60	22.79		
Surgery alone	164	33	53.65	26.70		
Surgery & chemo/radiation	209	39	56.35	25.25		
Amount of social support						
Poor	80	14	40.73	26.84	16.45	<0.01
Moderate	223	39	55.09	23.24		
Strong	262	46	57.75	24.28		
Satisfied with social support during treatment						
Agree	564	98	54.25	24.64	0.86	0.38
Disagree	9	2	48.75	36.25		
Satisfied with social support post-treatment						
Agree	555	98	54.32	24.61	2.25	0.13
Disagree	14	2	47.56	33.69		
Pre-diagnosis financial situation						
Difficult	174	32	58.98	22.81	4.66	0.03
Easy	372	68	54.39	26.51		
Cancer-related financial stress						
More difficult	272	51	59.89	24.45	13.56	<0.01
No change/less difficult	262	49	51.71	25.86		
Cancer-related financial strain						
More concerned	286	53	58.88	24.07	7.29	<0.01
No change/less concerned	258	47	52.51	26.56		

<sup>1</sup> oropharynx (C10), oral cavity (C00, C02-C08), larynx (C32), other (C01, base of tongue; C09, tonsil; C11, nasopharynx; C12, piriform sinus; C13, hypopharynx)

<sup>2</sup> within 8 months of diagnosis

**Table 2: Numbers of subjects<sup>1</sup>, mean overall, domain-specific and per question PTG scores, with 95% confidence intervals<sup>2</sup>**

	<b>n</b>	<b>Mean score</b>	<b>95% CI</b>	<b>Mean score per question</b>
Overall PTG	539	55.74	53.15 - 58.33	2.70
No-little PTG	218 (40.4%)			
Moderate-high PTG	321 (59.6%)			
Domain 1: Relate to Others	538	20.79	19.95 - 21.63	2.98
Domain 2: New Possibilities	529	8.70	8.09 - 9.31	1.93
Domain 3: Personal Strength	537	10.57	10.03 - 11.10	2.90
Domain 4: Spiritual Change	500	3.90	3.61 - 4.20	2.19
Domain 5: Appreciation of Life	538	9.13	8.74 - 9.52	3.29

<sup>1</sup> Survivors who completed all PTGI questions (or all questions in a domain) plus those who completed at least half, but not all, questions on the instrument (or relevant subscale)

<sup>2</sup> Higher score=more PTG

**Table 3: Variables associated with total PTG in multivariable model**

Variable	Unstandardised coefficient	SE	t-test	p value	F-Change	p value
Sex					10.72	<0.01
Male	Ref					
Female	7.21	2.33	3.10	<0.01		
Age					2.64	0.07
<60	Ref					
60-69	-0.54	2.51	-0.21	0.83		
70+	-7.90	2.87	-2.75	<0.01		
Amount of social support					16.41	<0.01
Poor	Ref					
Moderate	16.32	3.32	4.91	<0.01		
Strong	21.40	3.29	6.51	<0.01		
Cancer-related financial stress					5.02	0.03
More difficult	Ref					
No change/Less difficult	-8.36	2.24	-3.74	<0.01		
Constant=43.48						